June 18, 1986 Date.

Rockwell International

65950-86-275

TO: Name Organization Internal Address)
D. W. Lindsey FROM: (Name Organization, Internal Address, Phone)
R. T. Kimura

3-2092

Subject: .

Microcurie Release During Pressurizations in Double-Wall Tanks

Refs:

- RHO-HS-SR-85-2, 4Q GAS P, February 1986, R. C. Aldrich, L. J. Stanfield, "Radioactivity in Gaseous Waste Discharged from Separations Facility During 1985"
- (b) Letter, April 9, 1986, R. T. Kimura to W. H. Trott, "Characterization of Selected Double-Shell Tank Vapor Space Radionuclides - Final Report"
- DSI, May 13, 1986, R. E. Van der Cook to R. T. Kimura, "Tank Vapor Space"

SUMMARY AND CONCLUSIONS

An engineering analysis was performed to quantify a microcurie release from a double-wall tank during a pressurization. The analysis involved estimating a volume of vapor released from the tank through all major unfiltered pathways to the environment (Attachment I). The radionuclide concentrations in the primary tank vapor were determined from vapor space radionuclide characterization studies (Reference (b)). Mixing calculations were also performed to account for dilution and air displacement which occurs in release pathways during a pressurization. A statistical analysis of all data points was performed to determine the worst case concentration within 99.75 percent probability (Reference (c) and Attachment II). A review of 1985 tank pressurization data was also made for comparing actual data with worst case scenarios (Attachment III).

Conclusions made from the analysis are as follows:

- 1. For all statistical worst case scenarios, there is a 99.75 percent probability that the source term concentrations of vapor space radionuclides will not exceed 57 percent of 5,000 x Table II, thus providing a wide margin from immediate action levels (Reference (c)).
- 2. Mixing, dilution, and duration of pressurization are significant factors
- that reduce the IIII...

 15-minute duration is required better...

 those discharged to the environment after dilution IIIsland.

 A 30-minute pressurization of tank 102-AW to 5.0 inches WG with no dilution, and at a statistical worst case concentration of 57 percent of 5000 x Table II, would not cause the annual microcurie release from Table II discharge limits.

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D. W. Lindsey Page 2 June 18, 1986

- 4. There was only one verified pressurization of tank 102-AW out of 97 verified tank pressurizations during 1985. The highest pressure seen was 0.5 inches WG, but its duration was only two minutes. The highest pressure seen during 1985 for all tanks was 1.0 inch WG (see Attachment III).
- 5. Actual releases from a pit will be much less than presented in these conservative estimates. This is due to:
 - a. Actual source term concentrations for almost all of the tanks which pressurize are lower than 18 percent MIC.
 - b. The practice of taping the coverblocks to help control in-leakage flow rates also serves to reduce out-leakage during a pressurization.

RESULTS AND DISCUSSION

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Source Term Concentration

The beta-gamma activity present in the vapor space of tank 102-AW (Reference (b)) was higher than any other tank sampled, or 18 percent of the Maximum Instantaneous Concentration (MIC = 5,000 x Table II). Total alpha activity was measured and an Alpha Energy Analysis (AEA) is pending. Alpha activities could potentially be a limiting case. Assuming all of the alpha activity is 239 Pu, the highest alpha activity seen was 28 percent MIC in tank 102-AW.

Utilizing a standard deviation of all GEA sampling data, there is a 99.75 percent probability that the maximum beta activity will not exceed 26.9 percent MIC. Analysis of three tank 102-AW data points alone indicate that an upper limit of 57 percent MIC exists at the same 99.75 percent probability (Reference (c)). Tank 102-AW appeared to have the highest airborne activity, probably due to air lift circulator operation (Reference (b)).

Microcurie Release Estimates

Worst case microcurie release estimates were developed using the following basis: 1) eighteen (18) percent of MIC; 2) fifty-seven (57) percent of MIC; 3) flowrate estimates at 1-inch WG and 5-inches WG: 4) no dilution of vapors or displacement of air inside pits; 5) no "filtering" effects from line losses on piping and equipment; and 6) no taping of pit cover blocks.



D. W. Lindsey Page 3 June 18, 1986

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A correlation was developed using the two source term concentrations (Figure I). The statistical worst case was not found to be an emergency response condition (i.e., $5,000 \times \text{Table II}$). Hypothetically, a pressurization at this concentration and pressure may still release significant quantities of radioactivity. A 5-inch WG pressurization at 57 percent MIC (2,850 x Table II) could potentially release about 10 uCi per minute. This assumes that vapors do not mix with air inside the pits, and that vapors are discharged to the atmosphere directly from the tank vapor space.

Taping of the space between the coverblock and the pit is done for some pits in all of the double-wall tank farms. The extent of taping will vary in each farm. It will vary since taping is used as means of air in-leakage flowrate control. Seasonal weather changes also affect the amount of taping needed for vacuum/flowrate control (above that provides by flow control butterfly valves). Restricting the in-leakage also means that out-leakage during a pressurization is more restricted at a given pressure. The calculations presented in Appendix A assumed no taping, since imperfect sealing and the varying amounts of taping are difficult to quantify. However, it is estimated that over 50 percent of the coverblocks in all farms are taped. Outleakage will still occur through valve handle holes.

Actual source term concentrations are less than 18 percent MIC for eight of the nine tanks samples (Reference (b)). In addition, since only 1 out of 97 verified tank pressurizations occurred in tank 102-AW, which had 18 percent MIC. The actual activities released to the environment will be much less than 12 uCi for 99 percent of the tank pressurizations seen during 1985.

Actual releases for all tanks which pressurize may be 1/10 to 1/1000 of 12 uCi for both of these reasons.

Comparison to Stack Discharges

During 1985, the 241-AW tank farm had a beta activity discharge of 149 uCi per year based on monthly averages (Reference (a)). Under the worst case of 10 uCi/minute, a 30-minute pressurization would discharge 300 uCi of beta activity. If the activity due to this pressurization were added to the yearly average discharged from the stack, the resulting concentration would still be below Table II guidelines (Attachment I). Table II may be exceeded for RuRh106 only if the duration exceeds 98 minutes at worst case conditions. Isotopic distributions were assumed to be constant at the 1985 average value in this analysis.



D. W. Lindsey Page 4 June 18, 1986

Actual Pressurization Data for 1985

A review was made of all verified tank pressurization events in 1985 for comparison purposes to the conservative worst case scenarios developed here. Actual data for all of 1985 revealed that only one pressurization in tank 102-AW occurred out of 97 verified tank pressurizations (see Attachment III). The 97 verified tank pressurizations were caused by 50 verified "events." An event can cause multiple tank pressurizations. A single event in AW farm, for example, could possibly cause six tank pressurizations. The magnitude of the tank 102-AW pressurization was 0.5 WG, and it lasted for two minutes. An estimated 0.7 uCi were released for this event. For all tanks, only 3 of 97 events exceeded 30-minute duration, but these were at less than 0.1 in WG pressure.

There were five tank "pressurizations" (three events) not listed which lasted 105 and 120 minutes due to planned exhauster shutdowns. Their magnitudes ranged from 0.05 to 0.15 WG. These are mentioned since it must be emphasized that it is difficult to verify that these tanks actually pressurized. The accuracy of the instruments is \pm 0.05-inch WG, and the alignment of the strip chart, the width of the pen line, and the alignment of the pen, could add another 0.1 to 0.2-inch WG error to the zero position. Of the 97 tank pressurizations, 68 were less than 0.15 WG in magnitude.

Effect of Mixing and Dilution

37

The effect of mixing and dilution of the source term concentration with air inside the pits was significant. Using the highest actual concentration of 18 percent MIC from tank 102-AW, mixing calculations were performed on the following pathways (also see Attachment I).

<u>Location/Pathway</u>	Outleakage <u>Flowrate at (1 in. WG)</u>	Pit Volume <u>(ft</u> 3)
Central Pump Pit	22 CFM	960
AW-A Valve Pit	11 CFM	1106
AW-B Valve Pit	II CFM	1106
Service Pit	22 CFM	289
Feed Pump Pit	10.9 CFM	803
Flush Pit	22 CFM	108
Drain Pit	22 CFM	1613
Instrument/Equipment Tie-ins	10 CFM	0



D. W. Lindsey Page 5 June 18, 1986

The pipe volumes and outleakage flowrates were used with a perfect mixing assumption in order to calculate the diluted concentrations (see Figures II and III). From Figure III, it can be seen that a duration of over 15 minutes is needed before the concentration of vapors exiting the pit via cover blocks, equal those entering the pit via the drain lines. Short duration pressurizations are of lesser concern that those over 15 minutes.

There will also be radionuclide losses on drain lines, pit walls and equipment, and on coverblocks prior to discharge to the atmosphere. It was assumed in this study that no line losses occurred along the release pathway in order to be conservative. Actual release concentrations will be lower due to this and dilution effects. Actual outleakage flowrates may be less due to frictional losses, which were neglected here.

In addition to the recommendations made in Reference (b), it is recommended that all coverblocks be taped and sealed to the extent allowable and still maintain the necessary air in-leakage rates.

R. T. Kimura, Engineer Waste Concentration Unit

RTK:jmc

Att.

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cc: G. L. Dunford And

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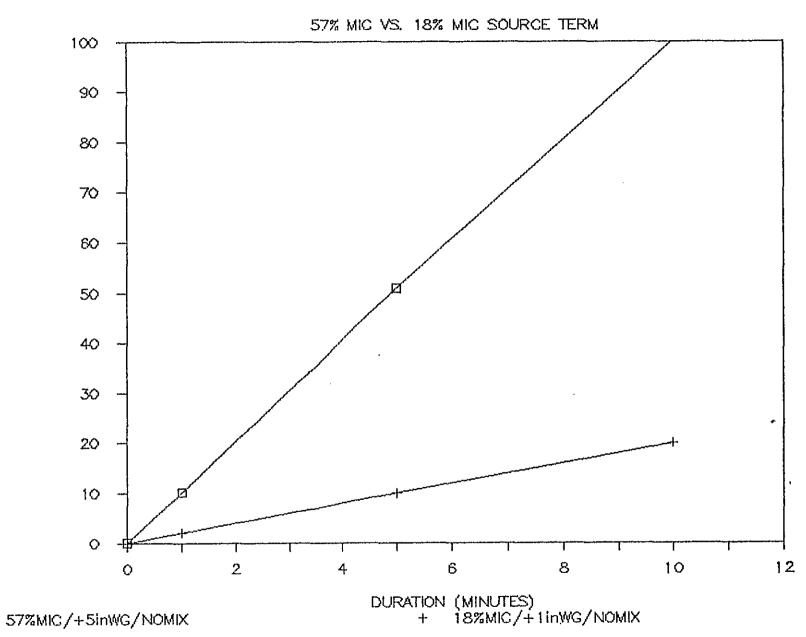
W. H. Trott w/o Att.

R. E. Van der Cook

T. B. Veneziano

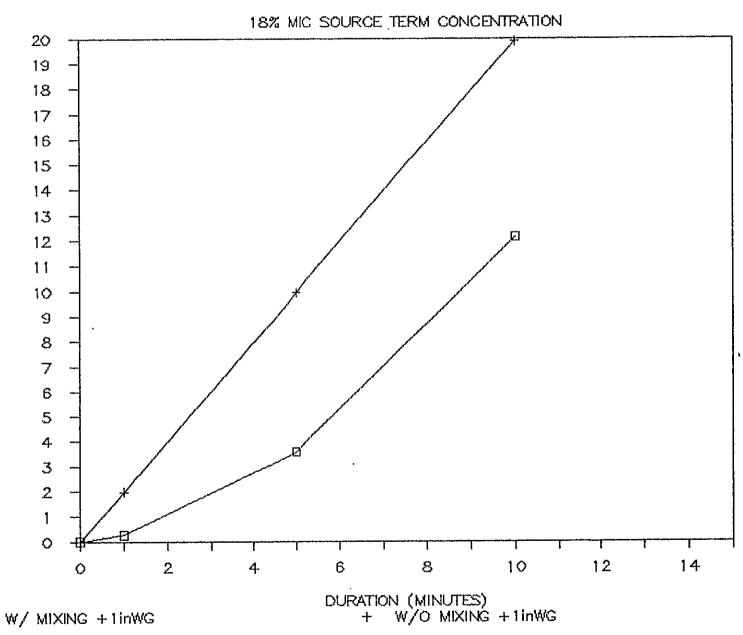
1 2 1 2 5 0

FIGURE I UCI RELEASE ESTIMATE



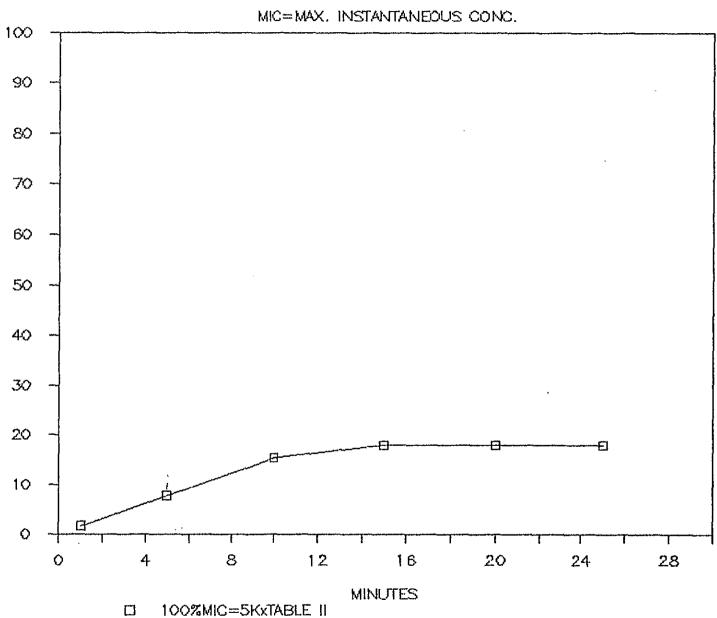
ACTIVITY (uct)

FIGURE II uCi RELEASE ESTIMATE



ACTIVITY (UCI)

FIGURE III 102-AW PRESSURIZATION +1in.WG - 187/100



PERCENT MIC (%)

ATTACHMENT I

ENGINEERING CALCULATIONS

100

- VOLUME RELEASED ESTIMATE-1.0inWG, Cases I,II(8pgs)
- 2. CURIE RELEASED ESTIMATE-1.0inWG, 18%MIC(2pgs)
- MIXING CALCULATION SPREADSHEET(1pg)
- 4. VOLUME RELEASED ESTIMATE-5inWG
- 5. CURIE RELEASED ESTIMATE-5inWG, 57%MIC-Worst Case

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	Energy Systems Group

1/8
PAGE
JOB NO. WBZ5H
DATE 4-30-86
BY R.T. KIMURA

(I)

FOR 102-AW VOLUME RELEASE ESTIMATE

ESTIMATE VOLUME OF VAPOR RELEASED FROM 102-AW DURING A PRESSURIZATION OF + 1.0 IN WG PRESSURE

BASIS

SUBJECT

PATHWAYS FOR UNFILTERED VAPOR RELEASE DURING PRESSURIZATIONS

ZUDR-MZY A. CENTRAL PUMP PIT B. VALVE PITS AW-A, AW-B 3"DR-369-N24/3"DR-361-M24 C INSTRUMENT/EQUIPMENT RISER TIE-INS 59 RISERS D. FEED PUMP PIT 340R-MZY E. FLUSH PIT 3"DR-362-MZY 3" DR-371-M2Y F SERVISE PIT DRAIN PIT (DONT RELEASE TO ATM)
SO DO NOT COUNT-6" 10" DR-334-1824 10" OR-335-MZY DOE 5 60 TO 242-A 6" DR-343- MZY H. DECON SHOWER -272-AW 3" DR-374-MZY I. 241-AW SEAL POT 3" DR -380 -MZY/ + Protected by Seal Luops and Hepo Fitters.

(ase I ISOTHERMAL FRICTIONAL FLOW (SEE DIAGRAM-CASE I)

NMa < 0.3, f = 1, Ca/PB = Pa/PB, Low AT

6 pipes are 6'long with 1 elbow, 1 expansion (10'eff)

3 pipes are 50'long with 5 elbows, 1 expansion (100'eff.)

Pressure in tank = Pa = +1.0 in. WC

Pressure in Atm = PB = 0 in. W6 = atmospheric

Ref. P.135, MCCabe/SMITH UNIT OPERATIONS OF CHEM. ENGR.

The Compressible flow through a conduit is: $\frac{M}{RT}(Pa^{2}-Pb^{2}) - \frac{G^{2}}{gc} \ln \frac{Pa}{Pb} = \frac{G^{2}f \Delta L}{Zgc V_{H}}$

where M = Molecular weight of gas = 29 16/16mol

R = Ideal Gas Constant = 1,545 16f-ft
T = Temperature = 550°R

BD-5400-060 (R-2-79)

PAGE	2/8
JOB NO	
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Pa = Tank Pressure 1.0 in. NG = 2122 16/ft abs.

Pb = Atmospheric Pressure Din NG = 2117 16/ft abs

G = Moss Velocity 16/ft s

Ca = Density of Tank gas

Cb = Density of gas at atmospheric

f = friction factor = 1 no friction

gc = Newtons Law Proportionality Factor = 32.174 15f-52

VH = Hydraulic Radius of Conduit (Ft) = D = 0.0625ft

AL = pipe Length

from (1)
$$G = \sqrt{\frac{M}{RT} (P_a^2 - P_b^2)}$$

$$\frac{1}{g_c} \ln \frac{P_a}{P_b} + \frac{f \Omega L}{2g_c \Gamma_H}$$

$$G = \frac{\frac{29.9 \, lb/b \, mol}{2122^2 - 2117^2/ft^4}}{\frac{(1545 \, lbf - 1t}{fb \, mol} \, (550 \, ^{\circ}R)}$$

$$\frac{1}{\frac{32.174 \, \frac{fl - 1b \cdot 1}{fb \, f - 52}}{\frac{1}{b} \, f - 52}} \frac{1}{h} \frac{\frac{2122}{2117}}{\frac{2127}{2117}} + \frac{(1)(10ft)}{2(32.174 \, \frac{ft - 1b}{fb \, f - 52})}(0.0625 \, ft)}$$

$$G = \sqrt{\frac{0.7234}{0.000733 + 2.49}}$$

PAGE_	3/8
JOB NO	•
DATE _	
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$$U = Velocity = G/Q \qquad Q = 0.0722 \frac{16/4361V@909F}{1595\times550}$$

$$U = PM/RT = \frac{14.7\times144\times29}{1595\times550}$$

$$U = \frac{0.54 \frac{16}{47^2 - s}}{6.0722 \frac{16}{47^3}} = \frac{7.5 \frac{4}{s}}{1595\times550}$$

$$V_{10ff} = U A = (7.5 \frac{4}{s})(\pi \frac{(0.25F^2)}{4})(60 \frac{5ec}{min}) = \frac{1}{22 cFM}$$

USING Case II, Vf = 100 CFM For Instrumentation/Eggst
lines

Upoff = 7.6 Ft/s

V100A = UA = (7,6 +1/s)(0.022 ft2)(603/m) = 10.0 CFM

:AT 5 minute duration (6 pipes @10', 3 pipes @100')
and 1.0 in. NG pressure (6) + 10 CFM] 5 min

$$V_T = [42]5 = 710 f1^3$$



4/2
PAGE
JOB NO
DATE
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FOR ______

CASE IT ASSUME leak OCCUPS ACROSS COVERBLOCK/
PIT WALL INTERFACE ASSUME ISOTHERMIC
FRICTIONAL FLOW, ALSO ASSUME THAT
COVER BLOCK PERIMETRIC DISTANCE COULD
BE CIRCULAR GEOMETRY.

Vy = Do-Di = 1/16 = 0.01563 ft

A. Central Pump Pit Perimeter = 42' Depth = 6' $42' = 2\pi r_i \Rightarrow r_i = 6.69' \Rightarrow A_A = 0.133 ft^2 (area of leak path)$

B Valve lits Perimeters = 56' but the into single 3"OR 56' = 2TTr; => r, = 8.91' => AB = 0.188 ft Depth = 67"

C. Feed Demp Perimeter = 36' Depth = 9'-11"
36' = 2Tr. => 1, = 5.73' => Ac = 0.024ft2

D Flush Pit Perimeter = 15'7" Depth . 5'6"

151 = 21Tr; => r; = 2.5' => Ap = 0.08 ft 2

E. Service Pit Perimeter = 22' $A_E = 0.057ff^2$ $F_1 = 3.5'$ Depth = 7'

F Inst lines @ 1/2" & perimeter = 0.13'

1: = 0.0208 Ap = 3.61-4 ft = x1 x59 = 0.022ft =

G. Drain Pit Back flows through 3 Coverblocks
Case I will be limiting

(H. SEAL LOOP PROTECTED I. HEPA FILTERED NOT A PROBLEM)

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PAGE 5/8	
JOB NO	
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from (1)
$$G = \frac{M}{RT} (PA^{2} - P_{\delta}^{2}) \frac{1}{\sqrt{g_{c}} \ln \frac{P_{c}}{P_{\delta}} + \frac{fAL}{2g_{c} r_{H}}}$$

$$G = \frac{29}{\sqrt{1545(506)}} (2122^{2} - 217^{2})$$

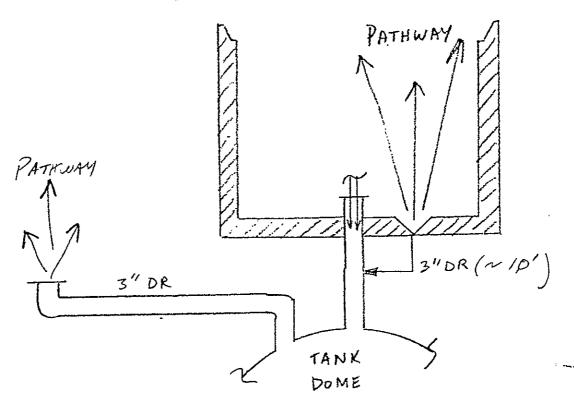
$$6 = \frac{\frac{29}{1545(506)}(2122^2 - 2117^2)}{\frac{1}{32.174}l_{1}\left(\frac{2122}{2117}\right) + \frac{1(2.4')}{2(32.174)(0.01563)}}$$

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PAGE	6/2
	
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DIAGRAM - CASE I NO COVER BLOCK POSSIBLE PATHWAYS



(NOT SHOWN - INSTRUMENT THE-INS TO RISERS)

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PAGE	7/8
JOB NO	
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DIAGRAM CASE II LEAK THROUGH COVER BLOCKS

Pit DIMENSIONS (GAP'S ALL ARE 1/32")

Perineter

10' (26')2

]121 (281)2

Central Pump P.t Value Pits AWA-AWB Drain Pit 02-D

75

14'8" 10' (24'8")2 +20

Fred Pump Pit Flush Pit Service Pit

9'	(18/2
5'¢	15,71
7'6	221

Instrument / Egpt Lines in Risers

PATHWAY

TUBING YZ"

COVER Blocks

0 1/32 GAP I.D. = 0.5IN

Path length estimate L = 20"(1.z)+5"=24" L = 2.42ff

= 2 r.

GAP = 1/32 11

Di=2r; A=T(ro2-r)2 A ASSOME CIRC. GEOM

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PAGE	8/8
JOB NO	· <u>·</u> ·······
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Calculate Duration Times NEEDED For displacement of Pit Air with tank vapors.

P, t	DIMENSOUS LXWXD	Volume (43)	Flow rate 1 At 1"WG(CFM)	Displacement Time (mm)	Case
,	16×10×6'	960	22	43.6	I
Valve ² AWA	14 x 12 x 6'7"	1106	22÷2.	100.5	I
	14 × 12 × 67"	1106	22 - 2-	100.5	I
Service.	TT (3.52)7'	269	2.2	12.2	I
Fee & Pump	9×9×911"	803	10.9	36.5	工
Flush	TT(2.5) 5.5'	108	22	4.9	I
Pruin	14'84x10x11	1613	22	73.3	I
lust C		-	10.0		I

NOTE 1: FROM CASES I + II; RATE LIMITING FLOWRATE USED -SINCE THIS WOULD BE THE THEBRETICAL FLOWRATE PUSSIBLE

NOTE 2: AW-A, AW-B DRAIN LINES JOIN AT A COMMON HEADER SO FLOW THROUGH 3" INF IS TOTAL FLOW FOR BOTH PITS:

3"OR361-MZY 0 3" A 3" > 3"OR-361-MZY

3"OR 369-MZY 0 3"

	1/2	
PAGE		
JOB NO		
DATE	5-12-86	
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LOCATION SUBJECT LURIE RELEASE ESTIMATE

102-AW - REAUSTIC CASE
1"W6, ~18% MIC

BASIS	pt	outleakage 1	Pit
Pit	Volume (f13)	Flow (CFM)	Volume (m1)
Central Pump	960	22	2.727
AW-A VP	1106	//	3.13
AW-B YP	1106	1/	3.13 ⁷
Service	269	22	7.616
Feed Pump	803	H.9	2,27
Flush	108	22	3.06
Equipment line Drain	!s - 6 3	/0.0	4.56
prain	כ וטו	22 = 130.9cf	M

Source Term Concentration 2
Average of (3) Samples taken (1×10-4 = 1-4), in MCi/m1

· ·	10/24/85	10/25/85	1/27/86	AVG
Cs 137	1,2 -7	2.3-7	4.4-7	2.63
C3134	2.4-7	5.4-9	1,6	2,46
Ru Rh 106	1-6-8	4.0-8	– ,	2.8 ⁻⁸ 3.53 6
m/	137	1.76	1.96	5.53°

Other Assumptions:

1 +10 in WG Pressurization - Limiting Flow-Case I &II
2 Corrected for filter efficiency + line loss per Letter 6595086-174-CI And all the other assumptions made There.

7

PAGE	2/2	
PAGE		_
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MAX. CURIE RELEASED

Graphs were generated with xwithout dilution

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ASSUME PERFEC	OF CURIE RELEAS T MIXING INSIDE OF PRESSURIZATION	PIT	APOR MIXING			AVG CS137 IS AVG CS 134 IS AVG RURH106	3.4E-07					
PIT	PIT VOL(CF)	FLOW(CFN)	PIT VOL(NL)			AIR DISPLACED)CS137 (uCI/#1) AVG	CS 137 uCi RELEASE	CS134(uCi/ml AV6	CS 134 uCi RELEASE	RU106(uCi/ml) AV6	RU 106 uCi RELEASE
CENTRAL PUMP	960	22	27182961.6		1MIN	622942.87	0.000000006	0.0037545286	0.0000000055	0.0034261858	0.0000000006	0.0003997217
AW-A	1106		31317037.01		IMIN						0.0000000003	
AN-B	1106		31317037.01		1HIN						0.0000000003	
SERVICE	269	22	7616892.365		1MIN	622942.87	0.0000000215	0.0133990611	0.0000000196	0.0122272801	0.0000000023	0.001426516
FEED PUMP	803	10.9	22737414.755		1MIN	308639.8765	0.0000000036	0.0011018405	0.000000033	0.0010054818	0.0000000004	0.0001173062
FLUSH	801	22	3058083.18		IMIN	622942.87	0.0000000536	0.0333735875	0.0000000489	0.0304549848	0.000000057	0.0035530816
DRAIN	1613	22	45673038.605		1HIN	622942.87	0.0000000036	0.0022345613	0.0000000033	0.0020391434	0.0000000004	0.0002379001
					IMIN							
'INST LINES		10			1MIN	TOT AIR DISP					WT AVE CONC	
					1HIN	3423354.2265	0.0000000162	0.0554930309	0.0000000148	0.0506400282	0.0000000017	0.0059080033
					5 HIN						0.0000000032	
HIC GRAF					5 MIN							0.002168472
	FRACTION OF I		5		5 MIN						0.0000000014	
Time(min)	CS137	CS134	RURH106	(SUM) X100	5 MIN							0.0356629004
		A 4677010F0		4 5151401574	5 KIN						0.0000000019	
	1 0.0064840536				5 MIN							0.0888270389
	5 0.0324202681				5 MIN	2114/14.22	0.0000000179	A* 0998940999	0.0000000154	0.020978388	0.0000000019	0.003473017
	10 0.0642409539 15	V.V/32/8654/	0.01/0783328	18	5 MIN 5 MIN	TOT ATO RICO	WT AVG CONC	CHR UC "LLI	WT AVS CONC	CHM UE PLE	WT AVG CONC	CHE OF HOT
	20			18	5 MIN				,			0.1477000822
	25			18	2 1111	1/110//1/100	0.000000011	110010501111	0.00000077	1,200007777	0.000000000	011417000022
_	ABLOZIC FIXIZ O	N TANK CONCEN	TRATION FROM!									
Unit the sail	,0,14 61011 0	Imm annari		Etna wiith	10 MIN	6171825	0.0000000597	0.368541317	0.0000000545	0.336311468	0.000000004	0.0392363379
					10 MIN							0.0085142144
CURIE RELEASE	ED GRAPH	SUM OF ALL u	Ci-NO MIXING		10 MIN						0.0000000028	
TIME	uCi-MIXING	uCi@lin/18%	uCi85in/57%		10 MIN	6171825	0.0000002131	1.3152403877	0.0000001945	1.2002193652	0.0000000227	0.1400255926

3057858.75 0.0000000354 0.1081557232 0.0000000323 0.0984972379 0.0000000038 0.0115146778

33916983.75 0,0000001606 5.4471484755 0.0000001466 4.9707818787 0.0000000171 0.5799245525

6171825 0.0000005308 3.2759228176 0.0000004844 2.9894352708 0.0000000565 0.3487674483

6171825 0.0000000355 0.2193426313 0.0000000324 0.2001605761 0.000000003B 0.0233520672

SUM OF UCI WY AVE CONC SUM OF UCI WY AVE CONC SUM OF UCI

0

1 0.2640410623

5 3.5610265584

10 12.137854906

0

1.98

9.95

19.9

0

10.18

50.9

100,18

10 MIN

10 MIN

10 MIN

10 MIN

10 MIN

10 MIN

TOT AIR DISP WT AVG CONC

10

DESIGN ANALYSIS

FOR _____

SUBJECT WORST CASE CURIE RELEASE

VOL. DISCH. EST. - 102-AW 5 in WG, 57% MIC

Case III 5.0 in W6 Pressurization - 3" pipe r = .0625 frum(!) 5 in W6 = .417 ft W6

PA = 339/+,417/ 14.7 14.7 14.7 144 142 = 2143 16/43 265

from (1) $G = \frac{29.9 (2143^2 - 2117^2)}{1545(550)}$ $\frac{1}{32.174} \frac{2143}{4 \frac{2143}{2117}} + \frac{10}{2(32.174)(.0625)}$

$$G = \sqrt{\frac{3.90}{3.79^{-4} + 2.49}} = 1.25 \frac{16}{14^2}$$

 $\frac{G_{5mWG}}{G_{1mW0}} = \frac{1.25}{0.54} = 2.31$

check $V_1 = K \sqrt{DP} = K \sqrt{1} = K$ answer $V_5 = K \sqrt{DP} = K \sqrt{5} = K(2.24)$ Close

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FOR ___ LOCATION ___ SUBJECT____

Case III (cont'd) 5.0 m W6 - Cover Blocks
$$G = \frac{29}{1545(500)} \left(\frac{2143^{2}-2117^{2}}{217}\right) = \frac{3.90}{32.174}$$

$$\frac{1}{32.174} \frac{1}{100} \frac{2143}{2117} + \frac{2.4}{2(32.174)(.01563)}$$

$$\frac{G_{5in}}{G_{1in}} = \frac{1.28}{0.55} = 2.33$$

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Lose I Disch @ 5in W6

AW B YP

25.4

25.4

50.8

: Factor up Curie Release figures by Some Figure

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BY	RTKIMURA
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SUBJECT WORST CASE CURIE RELEASE

WORST CASE BASIS

1. No Pit Mixing on Dilution

2. 5.0 in W6 Pressurization

3, 30 min Duration

Flow Rute at 5in W6 = 302.7 CFM 57% MIC 180/0 MIC 65137 1.2-7 Z.4-7 38⁻⁷ 38 7.6-7 \Z=1.19 \mu(i/m/ C5134 1.6-8 5.08-3 RURH 106 10 57%

302 CFM | 7.48/90 | 3.7856 | 1000 ml | 1.19 -6 ml = 10.18 mli % at 1 min => 10.18 xC1 5 min => 50.9 mC, 10 min => 101.8 mCi

Effect of 30 min Atssurization on Yearly Discharge - AWFarm

· 1985 Avg release from AW Farm Stack 296-A-27 = 149 MC:1

activity) MuRh 106 = 3-" n Ci/m/ = 15% Table II 2) Cs134,137 < 16% Table II

30 min / 10.18 MCi (allof1985) + 149 MCi = 454.4 total MCi released

Au Rh 106: 15% | 454.4 = 45.7 % of Table II
Cs 134,137 = 10 1/2 | 454.4 = 30.5% of Table II

To Exceed Table It in RURh 106

150(X) MCi = 100% Table I X = 993, (1 => 98 mm

1 R.C. Aldrich / C J. Stanfield - KHO-HS-SR-85-2-94 GAS

BD-6400-060 (R-2-79)

ATTACHMENT II

STATISTICAL ANALYSIS

De rigig

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DON'T SAY IT-- WRITE

DATE: May 13,1986

TO:R.T. KIMURA

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FROM: R.E. VAN DER COOK VA

SUBJECT: TANK VAPOR SPACE

The worst case vapor space content for both beta-gamma and alpha content was calculated from the data listed in your letter to Trott of April 9, 1986. The worst case was estimated by adding the product of the sample standard deviation and the "student t factor" to the sample mean. The resulting value is such that only 0.25 percent of the possible values should exceed this worst case value. that for beta-gamma values three values were calculated. In the first value tank 102 AW was excluded due to the air lift circulators increasing the vapor space concentration. In the second, 102-AW was included and in the third only 102-AW was used. In all cases the release is estimated to be less than 5000 times Table 11 values.

type	% MIC	
beta gamma	4.5	Excludes 102-AW
beta-gamma	27	Includes 102-AW
beta-gamma	57	Only 102-AW
alpha	37	All tanks

From this analysis the air lift circulators in 102-AW appears to be the limiting case and still provides a wide margin from the immediate action levels.

Details are provided in the attached table.

TANK	MIC % B-G		TANK	MIC % ALPHA	
AW-104	.13	.0169	AW-102	28.4	806.56
AW-105	.008	.000064	AW-102	22.5	506.25
AW-105	.0154	.0002372	AW-102	14.8	219.04
AW-105	2.4	5.76	SY-101	14.3	204.49
AW-106	. 1	.01	SY-101	9.4	88.36
AW-101	1.2	1.44	AW-102	8.8	77.44
AN-105	.002	.000004	AN-106	5.1	26.01
AN-106	1.3	1.69	AW-105	3.7	13.69
AN-107	. 94	.8836	AW-105	3.8	14.44
SY-101	2.9	8.41	AW-106	2.6	6.76
SY-101	.32	.1024	AN-105	.7	. 49
	:==========		AW-105	3.3	10.89
	9.3154	18.3132052	AN-107	1.4	1.96
,	10.4244163		AW-104	.35	.1225
	1.0424416			========	
STD.DEV	1.0210003		•	119.15	1976.5025
AVG	.8468545			962.4508929	
t,10,.00				74.0346841	
upper va			STD.DEV	8.604341	
			AVG	8.5107143	
			t,13,005		
				37.5298543	
TANK	MIC % 8-6		TANK	MIC % B-G	
AW-102	18	324	AW-102	18	324
AW-102	13	169	AW-102	13	169
AW-102	18		1111 2 2 2		
AW-104		324	AW-102	18	324
	.13	324 .0169	AW-102	18 ==========	324
AW-105					
	.13	.0169			=========
AW-105 AW-105	.13 .008	.0169 .000064		======================================	=========
AW-105	.13 .008 .0154	.0169 .000064 .0002372		49 16.666667	=========
AW-105 AW-105 AW-105	.13 .008 .0154 2.4	.0169 .000064 .0002372 5.76		49 16.6666667 8.3333333	=========
AW-105 AW-105 AW-105 AW-106	.13 .008 .0154 2.4 .1	.0169 .000064 .0002372 5.76 .01	STD.DEV	49 16.6666667 8.3333333 2.8867513	=========
AW-105 AW-105 AW-105 AW-106 AW-101	.13 .00B .0154 2.4 .1 1.2	.0169 .000064 .0002372 5.76 .01 1.44	STD.DEV AVG t,2,005	49 16.666667 8.3333333 2.8867513 16.3333333 14.089	=========
AW-105 AW-105 AW-105 AW-106 AW-101 AN-105	.13 .008 .0154 2.4 .1	.0169 .000064 .0002372 5.76 .01 1.44	STD.DEV AVG	49 16.6666667 8.3333333 2.8867513 16.3333333 14.089	=========
AW-105 AW-105 AW-106 AW-101 AW-105 AN-105	.13 .00B .0154 2.4 .1 1.2 .002	.0169 .000064 .0002372 5.76 .01 1.44 .000004	STD.DEV AVG t,2,005	49 16.666667 8.3333333 2.8867513 16.3333333 14.089	=========
AW-105 AW-105 AW-106 AW-101 AN-105 AN-106 AN-107	.13 .008 .0154 2.4 .1 1.2 .002 1.3	.0169 .000064 .0002372 5.76 .01 1.44 .000004 1.69 .8836	STD.DEV AVG t,2,005	49 16.666667 8.3333333 2.8867513 16.3333333 14.089	=========
AW-105 AW-105 AW-106 AW-101 AN-105 AN-106 AN-107 SY-101 SY-101	.13 .00B .0154 2.4 .1 1.2 .002 1.3 .94 2.9	.0169 .000064 .0002372 5.76 .01 1.44 .000004 1.69 .8836 8.41	STD.DEV AVG t,2,005	49 16.666667 8.3333333 2.8867513 16.3333333 14.089	=========
AW-105 AW-105 AW-106 AW-101 AN-105 AN-106 AN-107 SY-101 SY-101	.13 .00B .0154 2.4 .1 1.2 .002 1.3 .94 2.9	.0169 .000064 .0002372 5.76 .01 1.44 .000004 1.69 .8836 8.41	STD.DEV AVG t,2,005	49 16.666667 8.3333333 2.8867513 16.3333333 14.089	=========
AW-105 AW-105 AW-106 AW-101 AN-105 AN-106 AN-107 SY-101 SY-101	.13 .008 .0154 2.4 .1 1.2 .002 1.3 .94 2.9	.0169 .000064 .0002372 5.76 .01 1.44 .000004 1.69 .8836 B.41 .1024	STD.DEV AVG t,2,005	49 16.666667 8.3333333 2.8867513 16.3333333 14.089	=========
AW-105 AW-105 AW-106 AW-101 AN-105 AN-106 AN-107 SY-101 SY-101	.13 .008 .0154 2.4 .1 1.2 .002 1.3 .94 2.9 .32	.0169 .000064 .0002372 5.76 .01 1.44 .000004 1.69 .8836 B.41 .1024	STD.DEV AVG t,2,005	49 16.666667 8.3333333 2.8867513 16.3333333 14.089	=========
AW-105 AW-105 AW-106 AW-101 AN-105 AN-106 AN-107 SY-101 SY-101	.13 .008 .0154 2.4 .1 1.2 .002 1.3 .94 2.9 .32 58.3154 592.4070711	.0169 .000064 .0002372 5.76 .01 1.44 .000004 1.69 .8836 B.41 .1024	STD.DEV AVG t,2,005	49 16.666667 8.3333333 2.8867513 16.3333333 14.089	=========
AW-105 AW-105 AW-106 AW-101 AN-105 AN-106 AN-107 SY-101 SY-101	.13 .008 .0154 2.4 .1 1.2 .002 1.3 .94 2.9 .32 58.3154 592.4070711 45.5697747	.0169 .000064 .0002372 5.76 .01 1.44 .000004 1.69 .8836 B.41 .1024	STD.DEV AVG t,2,005	49 16.666667 8.3333333 2.8867513 16.3333333 14.089	=========
AW-105 AW-105 AW-106 AW-101 AN-105 AN-106 AN-107 SY-101 SY-101	.13 .008 .0154 2.4 .1 1.2 .002 1.3 .94 2.9 .32 58.3154 592.4070711 45.5697747 6.7505388 4.1653857	.0169 .000064 .0002372 5.76 .01 1.44 .000004 1.69 .8836 B.41 .1024	STD.DEV AVG t,2,005	49 16.666667 8.3333333 2.8867513 16.3333333 14.089	=========
AW-105 AW-105 AW-106 AW-101 AN-105 AN-106 AN-107 SY-101 SY-101 SY-101	.13 .008 .0154 2.4 .1 1.2 .002 1.3 .94 2.9 .32 58.3154 592.4070711 45.5697747 6.7505388 4.1653857 3.3725	.0169 .000064 .0002372 5.76 .01 1.44 .000004 1.69 .8836 B.41 .1024	STD.DEV AVG t,2,005	49 16.666667 8.3333333 2.8867513 16.3333333 14.089	=========

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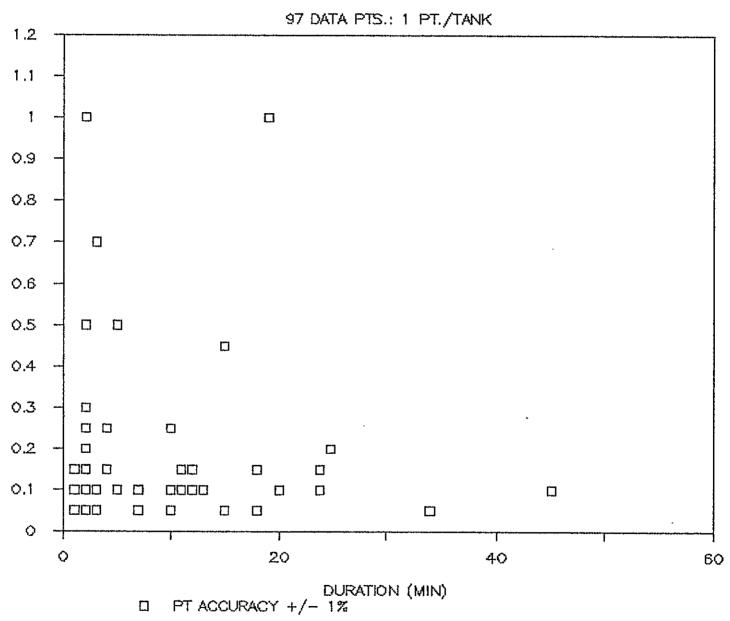
ATTACHMENT III

1985

ACTUAL PRESSURIZATION DATA
FOR ALL VERIFIED PRESSURIZATION EVENTS

(per tank basis)





SUSPECTED PRESSURIZATION EVENTS IN AN,AN,AY,AZ,SY FARMS

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NOTE: "PRESSURIZATIONS" UNDER 0.1 in NG
ARE WITHIN ACCURACY OF ZERO AND ARE
TYPICALLY DUE TO MAINT. SHUTDOWNS, ETC

DATE 1985	TANK	DURATION (MIN)	MAGNITUDE (in WG)	
JANI	1AN	15	0.45	
	2AN	10	0.1	
	3AN	10	0.25	
JAN4	1AZ	2	0.05	
	2AZ	2	0.05	
	1AY	2	0.05	
	2AY	2	0.05	
JANB	3AH	4	0.15	
JAN14	3AH	i	0.1	
JAN30	3A₩	3	0.7	
JAN31	157	13	0.1	
FEB1	3AH	2	1	
FEB5	1AZ	2	0.05	
	2AZ	2	0.05	
	1AY	2	0.05	
FEB9	2A₩~		0.5	
	4AH	2	0.15	
FEB14	157	3	0.05	
	25Y	3	0.05	
	35Y	3	0.05	
FEB15	3AW	3	0.05	
MAR11	3A#	15	0.05	
HAR22	6a₩	2	0.3	
MAR26	3AN	1	0.05	
MAR27	ian	2	0.2	
APR4	15Y	7	0.05	
	25Y	7	0.05	
	3 5 Y	7	0.05	
APR18	5AW	7	0.05	
	6AH	7	0.05	
APR26	157	7	0.05	
	3 S Y	7	0.05	
	35Y	3	0.05	
JUN7	24₩ •		0.1	
JUN20	1SY	105	0.1	Exhauster
	257	105	0.1 (FXNUOSICI
	38 Y	105	0.05	240 10 m
JUN26	157	18	0.15	
	25Y	18	0.05	
JUL16	1AW	2	0.3	
JUL 23	1AW	5	0.5	
	3AH	3	0.1	
B141 M.C	JAN	2	0.2	
JUL28	1AN	19	1	
	2AN	11	0.1	

	3AN	12	0.1
	4an	12	0.1
	5an	12	0.15
	6AN	11	0.15
	7AN	11	0.15
AU61	2AZ	2	0.1
AU623	1AZ	i	0.05
		1	0.05
	2A2	1	0.05
	·	1	0.05
	1AY	ī	0.05
	2AY	1	0.05
AUG27	1AZ	i	0.05
	2AZ	1	0.1
	1AY	1	0.05
	2AY	i	0.05
SEPT3	15Y	34	0.05
SEPT12	1SY	20	0.1
	35Y	20	0.1
	354	2	0.1
	157	2	0.1
	2AZ	7	0.1
SEPT13	1AZ	48	0.1
SEPT17	157	5	0.1
WE: 127	35Y	4	0.25
	35Y	2	0.25
	157	2	0.1
SEPT18	2AZ	3	0.05
SEPT19	2AZ	2	0.03
DEI 127	38Y	2	0.25
	35Y	2	0.25
SEPT22	1AZ	2	0.1
	2AZ	2	0.1
SEPT30	384	i	0.15
DCT 2	157	24	0.15
	25Y	24	0.1
	35Y	25	0.2
NOV20	1AN	10	0.05
	3AN	10	1.0
	4AN	10	0.05
	5AN	10	0.05
	6AN	10	0.05
NOV28	25Y	2	0.15
DEC10	Jah	3	0.1
DEC11	357	15	0.05
DEC14	35Y	120	0.15
	An I	4 4.V	A# 10

V